Abstract: We conducted an environmental study to try to at least partially explain why some areas of Maricopa County, AZ had significantly more cases of human WNV infection in 2004 than other areas. We developed and used an assessment tool, and the results suggested significant correlations between high case count areas and the presence of greater canopy cover and older age of construction.

Comparison of Environmental Factors Between West Nile Virus Case and Control Areas in the Greater Phoenix, AZ Area, 2004

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Introduction: West Nile virus (WNV) first appeared in Arizona in 2003. The first year was relatively mild with just 14 human cases reported. The second year (2004) reached outbreak proportions with 391 cases reported. Of these, 355 (91%) occurred in Maricopa County (see map at right). Case mapping revealed that some predominately residential zip codes had no WNV cases reported whereas other zip codes with comparable populations had above average numbers (7 or more cases). We wanted to see if the different numbers of cases observed within zip codes could be associated with differences in certain environmental variables.

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Distribution of Human WNV Cases in Maricopa County, Arizona, 2004













Phoenix area home landscaping can vary considerably, from virtually no vegetation (left) to lush and tropical (right). It's easy to envision that adult mosquitoes would find little harborage at the properties on the left compared with those on the right.

METHODS: Maricopa County is in south central Arizona and has a desert climate with about 5-7 inches of rain per year. In spite of the dry climate, a variety of environmental conditions occur at home sites throughout the county due to different preferences in property landscaping. Home site habitats vary from xeric/barren rock to lush tropical landscapes (see photo series above). We developed a survey tool to measure environmental variables at 40 case home sites within high case zip codes (7 or more cases), and at 45 control home sites selected randomly within no-case zip codes (0 cases). Environmental variables we assessed include landscape features such as ground cover (rock vs. lawn), irrigation type (flood vs. sprinkler vs. none), tree type and height, amount of tree canopy/shade, shrubs, presence of swimming pools, containers and/or yard clutter. We noted each of these environmental variables, and canopy coverage over each property was assessed and recorded as a percentage. We calculated frequency rates for the different variables and compared high case zip codes with no case zip codes (control) using Chi-square analysis. For this study, we assumed that most WNV case patients were exposed to infectious mosquitoes at the home site.











One of the questions we most often hear is, "How can Arizona have a West Nile virus problem when it's a desert and there are no places for mosquitoes to breed?" The answer is that human activity, from overwatering, to neglect of swimming pools, to poor design of drainage systems and accumulation of clutter, provides ample breeding situations for mosquitoes.

Results: Differences were noted to at least the 95% probability level between case and control populations in the following variables: percent canopy cover and age of construction. Older neighborhoods (pre-1990) were more likely to have irrigated lawns and fuller, denser vegetation. Significant differences were not seen in the following variables: presence of swimming pools, birds, outside storage and clutter; and proximity to greenbelts and drainage features. Presence or absence of grass lawns was near, but did not meet, the 95% probability level and might have proved to be a significant variable had the sample size been larger.

% Canopy Cover: <25% >25%	High Case Area 17 20	Control Area 20 12	Probability 0.011*
Age of Construction: <1990 1991-2004	High Case Area 33 4	Control Area 28 16	Probability 0.008*
Ground Cover: Lawn No Lawn	High Case Area 18 14	Control Area 15 29	Probability 0.054
Presence of Birds: Yes No	High Case Area 17 23	Control Area 23 22	Probability 0.427
Near Greenbelt: Yes No	High Case Area 30 10	Control Area 30 12	Probability 0.861
Swimming Pool: Yes No	High Case Area 9 29	Control Area 7 37	Probability 0.376
*Statistically significant at the 95% level or greater			

Results Table: Number of houses with each env. variable, 2004.



Conclusions: Definitive answers as to why Arizona experienced this outbreak will probably never be fully forthcoming, but these results suggest that features of mature, non-water conserving neighborhoods may be contributing factors to the breeding and harborage of WNV-carrying mosquitoes and increased incidence of human WNV infection.

